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INFLUENZA STUDIES

I. IMMUNITY IN INFLUENZA *

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Opinion has long been at variance with respect to the degree and duration of immunity conferred by an attack of influenza. Some observers have asserted that one attack imparts little or no protection against subsequent attacks. Parsons [1] cites the medical officer of health of Ulverston as having had the disease in 1857, again in 1890 and three times in 1891. Squire [2] declares that second attacks are observed frequently when one epidemic succeeds another: "Not only is one attack not protective against a recurrence, but it seems to me rather to predispose to it." Other opinions to the same effect are quoted by Parsons [1] and by Leichtenstern.[3]

On the other hand, the belief has been expressed [4] that the relatively low attack rate in elderly persons observed in 1918 was due to an immunity acquired in 1889-1890. Unfortunately for the latter view, the age incidence of the disease seems to have been the same in 1889-1890 and in earlier epidemics as it was in 1918, although the intervals between successive epidemics have been of different length. The case rate per 1,000 population in 1918 in the age group 60-70 was apparently much lower than the case rate in the age group 35-45 [5] in spite of the fact that the members of both of these groups were exposed, presumably in equal degree, in the 1889-1890 epidemic.

Much confusion doubtless has been introduced into discussions of immunity to influenza by the impossibility of making a definite diagnosis. Since influenza cannot even now be identified with certainty either clinically or bacterially, recognition of a genuine second attack is necessarily conjectural. One of us has described two cases of supposed second attacks following soon after the first attack, in which it

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[1] Report to Local Government Board, 1893, p. 51.

[2] Lancet, 1890, 1.

[3] Influenza: Nothnagel's Specielle Path. u. Ther., 1896, 4, p. 54.

[4] Jour. Am. Med. Assn., 1918, 71, p. 1595.

[5] Frost, W. H., and Sydenstricker, E.: Public Health Reports, March 14, 1919.

is a plausible assumption that influenza-like symptoms were caused by infection with a micro-organism differing from that responsible for the primary attack of true influenza.[6] Perhaps a considerable proportion of so-called relapses may be explained in this way. Evidence supposed to be obtained from the presence or absence of the Pfeiffer bacillus [7] is certainly not convincing since this organism is found in a considerable proportion of normal throats as well as in several diseases, such as whooping-cough and measles, in which it can hardly be the primary exciting cause.

The question of immunity can probably be best approached in connection with cases occurring in successive waves of the disease separated by months or years. Aside from the opinions of individual physicians based on personal experience little information is available. Exact numerical data hardly exist. One of the few definite instances in the literature is given by Parsons and refers to the experience in the Industrial Schools at Swinton near Manchester. In March, 1890, 171 of 589 children had influenza. In 1891, when a second epidemic occurred, there were in the schools 449 children who had been there at the time of the first epidemic. Four cases (2.6%) occurred among the 150 who had had influenza in 1890, and 17 (5.7%) among the 299 who had escaped the first visitation. The existence of a slight degree of immunity has been inferred from these figures, but the numbers dealt with are too small to carry conviction.

The successive waves of influenza in 1918-1920 have given some opportunity to study the question of immunity. At the San Quentin prison in California it was observed that men who entered the prison after the April (1918) epidemic were attacked in later outbreaks in the same year "in greater numbers than those who had come before, although there were more of the latter than the former." [8] Italian observers have reported that when certain hospitals and asylums were visited by influenza inmates who had previously suffered an attack were exempt.[9] Ovazza,[10] however, notes that a number of persons who had had influenza in the spring of 1918 contracted it anew in the fall, although the return cases were strikingly mild and always free from complications.

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[6] Jordan, E. O.: Jour. Infect. Dis., 1919, 25, p. 28.

[7] Thalman: Archiv. f. Hyg., 1913, 79-80, p. 142.

[8] Stanley, L. L.: Public Health Reports, May 9, 1919, p. 996.

[9] Scoccia: Policlinico, 1918, 25, p. 1249; abstr. in Jour. Am. Med. Assn., 1919, 72, p. 529. Folcioni: Policlinico, 1919, 26, p. 133; abstr. Jour. Am. Med. Assn., 1919, 72, p. 1039.

[10] Policlinico, 1919, 26, p. 271; abstr. Jour. Am. Med. Assn., 1919, 72, p. 1335.

In Spain it was observed that towns that were spared at the first invasion, such as Barcelona, suffered most at the second invasion.[11] It was thought, too, that the incidence of the disease in the barracks indicated the existence of same degree of immunity among the soldiers who had had the disease in the spring.[11] Joltain and Banfle[12] record the instance of a troop of soldiers from Indo-China nearly all of whom had the disease lightly in the spring of 1918. When the disease reappeared in October it spared this troop completely, while troops and civilians in the vicinity developed it.

The following observations, on about 6,000 men of approximately the same age living in barrack organization in the vicinity of Chicago, are offered as a contribution to this question.

Great Lakes Naval Training Station.—Through the courtesy of the post commandant we have been enabled to make inquiry concerning the influenzal history of the recruits at the Great Lakes Naval Training Station during and following the outbreak in January, 1920. The post strength is about 5,500 to 6,000 men. Most of them are young recruits, averaging perhaps 20 to 21 years of age. Nearly all had been home during the 1918 influenza epidemic, and with rare exceptions do not appear to have received vaccine against respiratory infection.

The 1920 epidemic of influenza broke out in January, the first cases coming to the hospital January 12. The origin of the outbreak is uncertain. In the Radio School, the first organization affected, were regiments that had just arrived from the Norfolk Station and many other men returning from furloughs.

This year's influenza epidemic at the Station is considered similar in practically all respects to that of last year. The symptoms were the same, though perhaps of less average severity. We studied twenty cases in detail. Coming on with a mild chill or chilly sensation, the temperature rose to somewhere between 100 and 105 F., usually between 102 and 104. It frequently became normal in a day or so and remained normal, but sometimes an irregular, low-grade fever continued for several days. Most of the patients had a headache — often frontal — sometimes severe. Half of them had general aching, backache and other symptoms. Practically all coughed, and many raised a little sputum. The throat often became irritated or slightly sore. Those seen during the fever were flushed; pneumonia patients only were cyanosed. The throat appeared normal or generally hyperemic. Rhinitis was rare. Acute infections of the nose, accessory sinuses, tonsils, etc., were not found. The pulse was somewhat slower than the degree of fever led one to expect. The leukocyte count varied from 4,800 to 15,000. Throat cultures from tonsil and nasopharynx swabs were positive for hemolytic streptococcus and Pfeiffer's bacillus in nearly all cases and for other organisms less frequently.

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[11] Jour. Am. Med. Assn., 1919, 72, p. 665.

[12] Bull. de la Soc. méd. d. hôp., 1918, 42, p. 991; abstr. Jour. Am. Med. Assn., 1919, 72, p. 529.

With the cordial cooperation of the post authorities we were able to have a few brief, simple questions put to approximately 4,000 men at the post and the results recorded on typewritten forms.

The men's statement regarding previous influenza was accepted whenever the attack was said to have occurred during the influenza period of 1918-1919, i. e., in September, October, November, December, January, February and March. The great majority were reported for the period of September to December. Only a few cases were reported as occurring in March, and perhaps these actually occurred somewhat earlier than the men recalled. A few cases were accepted as influenza when reported as occurring in Europe during July and August, 1918.

The possibility that various noninfluenzal affections might have been diagnosed as influenza during the 1918-1919 period was tested by closer questioning of a few hundred men. Patients at the main hospital who gave a positive history during that period (September to March) in nearly all cases remembered typical influenza symptoms: fever, aching and other symptoms, with cough and without much sore throat, occurring in the midst of local epidemics. We are convinced that most of these patients knew whether they had had actual influenza. It seems probable that the same is true of the men throughout the post area.

Table 1 indicates the number of men who had influenza previously and again in 1920, the number that had influenza previously but not in 1920, the number that did not have influenza previously but did in 1920, and the number that had not been attacked at all. Those listed as doubtful gave a history of influenza occurring at a time, in most cases, when the disease was not prevalent. A few company reports that did not differentiate between 1918 and 1920 attacks are not included; the reports of 662 men were thus discarded.

From table 1 it appears that of 3,905 men who gave a clear history, 1,112 had had influenza in 1918-1919 (28.5% incidence), and 881 were attacked in 1920 (22.6%).

Of the 1,112 who had had influenza, 236, or 21.2%, had a repeated attack in 1920, while of 2,793 who had not had a previous attack, 645, or 23.1%, were attacked in 1920.

TABLE 1

INCIDENCE OF INFLUENZA IN 1918 AND 1920 AMONG THE MEN AT THE GREAT LAKES TRAINING STATION IN JANUARY, 1920

	Influenza in 1918-1919, Also in 1920	Influenza in 1918-1919, Not in 1920	No Attack in 1918-1919, Influenza in 1920	No History of Influenza	Doubtful History
Hospital	113	7	264	9	7
Aviation	81	421	217	993	95
Radio	11	163	71	469	30
Signal	2	10	7	26	3
16th Regiment	20	127	40	232	16
13th Regiment	4	38	11	94	9
3rd Regiment	5	110	35	325	21
Total	236	876	645	2,148	181

Table 2 is to be read as in the Great Lakes series:

TABLE 2

INCIDENCE OF INFLUENZA IN 1918 AND 1920 AMONG THE MEN AT CAMP GRANT, ROCKFORD, ILLINOIS, IN JANUARY, 1920

	Influenza in 1918-1919, Also in 1920	Influenza in 1918-1919, Not in 1920	No Attack in 1918-1919, Influenza in 1920	No History of Influenza	Doubtful History
Headquarters Troop, 6th Division	2	11	5	25	1
318th Engineers	5	35	10	154	9
3d Field Artillery	4	46	10	162	10
78th Field Artillery	1	11	6	126	4
11th Field Artillery	13	60	48	285	15
Provisional Recruit Company	1	38	4	175	27
6th Ammunition Train	0	0	2	5	1
6th Field Signal Battalion	0	5	5	41	4
52d Infantry	4	9	9	102	4
53d Infantry	0	5	12	60	2
54th Infantry	0	7	3	78	2
16th Machine Gun Battalion	1	3	2	20	0
17th Machine Gun Battalion	1	1	1	26	0
18th Machine Gun Battalion	0	5	1	30	0
Medical Detachment, Camp Hosp.	12	21	30	79	5
Motor Transport Corps	3	11	6	108	9
Quartermaster Corps	13	26	52	225	7
Cooks and Bakers	1	7	6	44	2
Remount Depot	0	21	8	85	8
Stockade	0	7	7	25	4
	61	329	227	1,855	114

Camp Grant, Rockford, Ill.—The 1920 influenza epidemic at Camp Grant, Rockford, Ill., was somewhat less severe than that at Great Lakes. It occurred at about the same time, reaching its height on Jan. 12, 1920. The age and previous history of the men were very similar to those at Great Lakes. Many were recruits, but some had returned from overseas service.

The camp surgeon kindly undertook to have the men report any history of influenza before 1920, with place, month and year of attacks. We have accepted the histories of the reported cases that occurred during the 1918-1919 epidemic period, as outlined above for the Great Lakes series. Discards were made for various errors of record covering 676 men.

Table 2 shows that of 2,472 men at Camp Grant, 390, or 15.8%, had influenza in 1918-1919, and 288, or 11.7%, in 1920. Official figures on the 1920 epidemic up to the time of our census showed 471 cases among 4,400 men, or 10.7%. Of the 390 men with previous influenza history, 61, or 15.6%, had a repeated attack, while of 2,082 without previous history of influenza, 227, or 10.9%, were attacked in 1920.

SUMMARY

Influenza epidemics broke out about Jan. 12, 1920, at the Great Lakes Naval Station containing perhaps 5,500 or 6,000 men, and in Camp Grant containing perhaps 4,400 men. In each post a census was taken in order to divide the men into the groups of those attacked and those not attacked in the 1918-1919 epidemic, and to determine the number in each group attacked in the recent epidemics. The results are:

TABLE 3

INFLUENZA ATTACK RATE IN JANUARY, 1920, IN MEN WITH AND WITHOUT PREVIOUS INFLUENZA HISTORY

	Number Giving Definite History	Number that Had Influenza in January, 1920	Percentage Attacked in January, 1920
Great Lakes			
Number that had influenza, 1918-1919	1,112	236	21.2
No history of influenza	2,793	645	23.1
Camp Grant			
Number that had influenza, 1918-1919	390	61	15.6
No history of influenza	2,082	227	10.9
Totals			
Number that had influenza, 1918-1919	1,502	297	19.8
No history of influenza	4,875	872	17.9

These results indicate that no marked immunity to influenza exists 12 to 15 months after a previous attack. They do not show that some degree of immunity may not obtain at an earlier period.